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A new occurrence of *Gomesa leinigii* (Pabst) M.W. Chase & N.H. Williams (Orchidaceae) and new populations of *Macradenia paraensis* Barb.Rodr. (Orchidaceae) and *Peperomia psilostachya* C.DC. (Piperaceae) in São Paulo state, Brazil

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Abstract

We present the first record of *Gomesa leinigii* (Pabst) M.W. Chase & N.H. Williams in São Paulo state, Brazil, previously known only in the state of Paraná, extended its geographical distribution. We also document newly discovered populations of *Macradenia paraensis* Barb.Rodr. and *Peperomia psilostachya* C.DC. in São Paulo state, Brazil. Description, comments, conservation status, photographic figures and a distribution map of these species are presented.

Key words

Epiphytic flora; IUCN Red List categories; Parque Estadual do Morro do Diabo; seasonal semi-deciduous forest.

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Introduction

Orchidaceae Juss. is the largest family of angiosperms, comprising 899 genera and 27,801 species (The Plant List 2018), with 220 genera and 2,475 species in Brazil (Flora do Brasil 2018). *Gomesa* R.Br. has 124 species (The Plant List 2018), with 75 occurring in Brazil (Flora do Brasil 2018). Chase et al. (2009) expanded the genus, including most of the Brazilian taxa belonging to *Oncidium* Sw. This genus has the Brazilian Atlantic Forest as its center of diversity, extending to northern Argentina and the Peruvian Amazon. An easily recognizable feature for most species is the presence of fused lateral sepals (Neubig et al. 2012).

Macradenia R.Br. includes 11 species, 5 of which occur in Brazil (Flora do Brasil 2018, The Plant List 2018). It is distributed from the southern part of Florida (USA) to Brazil and Bolivia, and its species have a well-developed clinandrium and prominent rostellum, with the anther elongated and arranged in the dorsal part of the column (Nebuig et al. 2012, Pupulin and Ossenbach 2002).

Piperaceae Giseke is an important family of magnoliids, especially known for containing an important spice,

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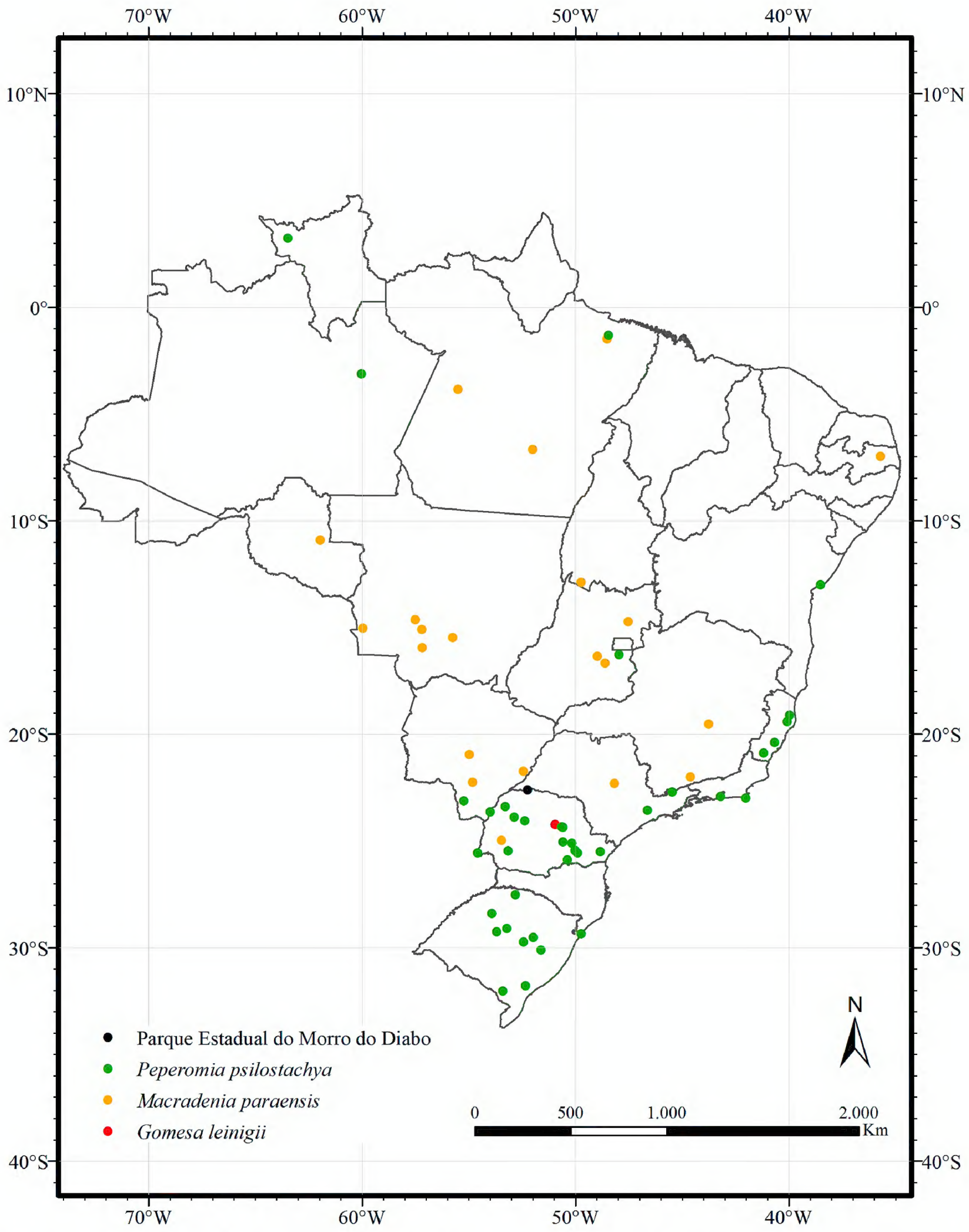

Figure 1. Map of the distributions of *Gomesa leinigii*, *Macradenia paraensis*, and *Peperomia psilostachya* in Brazil, and location of the PEMD where the species were collected.

black pepper (*Piper nigrum* L.), and many species with ornamental potential (Guimarães and Carvalho-Silva 2012). This family has a Pantropical distribution and comprises 5 genera and 3,600 species (Smith et al. 2008). In Brazil, there are 4 genera and 464 species (Flora do Brasil 2018). *Peperomia* Ruiz & Pav. is among the largest genera of magnoliids, including more than 1,600 species, of which 171 occur in Brazil (Frenzke et al. 2015, Flora do Brasil 2018, The Plant List 2018). Its species have Pantropical distribution and its center of diversity is found in the Neotropics (Wanke et al. 2006). This genus is characterized mainly by the reduction of floral structures, presenting a carpel and 2 stamens (Carvalho-Silva 2008).

Methods

Parque Estadual do Morro do Diabo (PEMD) is located in the municipality of Teodoro Sampaio in extreme southwestern São Paulo state, (Fig. 1) and with 33,845.33 ha represents the largest continuous remaining area of semideciduous seasonal forest in the interior of the state (São Paulo 2006). Despite the extensive area, it is poorly studied. Previous studies in the PEMD exclusively treated the arboreal component of the flora (São Paulo 2006), were carried out only along the Paranapanema River, and covered only approximately 10% of the park's area (Baitello et al. 1988).

Our new records were made from February 2016 to April 2017 during expeditions to collect botanical material to characterize the epiphytic flora of the PEMD. We deposited our specimens at HASSI (acronym according to Thiers 2018). The geographic distributions of the 3 species were verified using herbarium records and the literature (Pabst 1972, Brako et al. 1993, Ferreira et al. 2010, Mai et al. 2016, Flora do Brasil 2018, Govaerts 2018, SpeciesLink 2018).

Results

Orchidaceae

***Gomesa leinigii* (Pabst) M.W. Chase & N.H. Williams**, Ann. Bot. (Oxford) 104 (3): 397. 2009.

≡ *Oncidium leinigii* Pabst, Bradea 1(20): 182. 1972 ≡ *Baptistonia leinigii* (Pabst) Chiron & V.P. Castro, Richardiana 4: 118. 2004.

Figures 1, 2A–C

New record. Brazil. São Paulo state. Municipality of Teodoro Sampaio, Parque Estadual do Morro do Diabo: 22°36′14.9″ S, 052°18′00.7″ W, 277 m elev., 20 May 2016, *Seidinger LC 45* (HASSI 01174); 22°35′33.5″ S, 052°14′40.1″ W, 297 m, 20 October 2016, *Seidinger LC 145* (HASSI 01176).

Description. Epiphyte, ca 20 cm tall. Roots thin, flexuous, glabrous. Pseudobulbs 2–5.9 × 0.6–1.1 cm, conical to piriform, partially covered by 1 bract, 4.1–5.8 × 1.4–3.6 cm, membranaceous, ovate, apex acute. Leaves 12.3–14.6 × 1.4–1.8 cm, 2 per pseudobulb, subcoriaceous, oblong to elliptic, apex acute, base conduplicate. Inflorescence 1–2, lateral, pendant, 10–38-flowered, to 16–34.5 cm long; triangular membranous bracts with apex acute. Flowers with sepals and petals yellowish-green with brown spots; lip yellow with brown spots. Dorsal sepals ca 0.9 × 0.4 cm, obovate, concave, apex obtuse to retuse, base cuneate; lateral sepals fused with apex free, ca 1.1 × 0.7 cm, obovate, acute apex, acute base. Petals ca 0.8 × 0.6 cm, obovate; obtuse apex, cuneate base. Lip ca 0.7 × 0.9 cm, 3-lobed; lateral lobes elliptic, apex rounded; midlobe obovate; base of the callus ending in 2 well-differentiated teeth, middle part verrucous and apex short. Column ca 0.6 × 0.4 cm, subcylindrical, pubescent, base narrow, apex dilated, with 2 well-developed lateral wings; clinandrium with margin extending beyond the anther. Pollinia 2, ca 0.05 cm long, obovate, dorsal-ventrally flattened; stipe ca 0.15 cm long, linear with apex expanded. Fruit not observed. It was observed with flowers from December to May.

***Macradenia paraensis* Barb.Rodr.**, Gen. Sp. Orchid. 1: 139. 1877.

= *Trichopilia multiflora* Kraenzl., Xenia Orchid. 3: 152, pl. 288, fig. I, 1–7. 1900. ≡ *Macradenia multiflora* (Kraenzl.) Cogn. in: Martius et al., Fl. Bras. 3(6): 115. 1904.

Figures 1, 2D–F

New record. Brazil. São Paulo state. Municipality of Teodoro Sampaio, Parque Estadual do Morro do Diabo: 22°35′54.1″ S, 052°14′46.7″ W, 293 m, 18 August 2016, *Seidinger LC 101* (HASSI 01175).

Description. Epiphyte, caespitose, 15–28 cm tall. Roots thin, flexuous, glabrous. Pseudobulbs 4.5–8 × 0.7–1.5 cm, conical to piriform, partially covered by 3–4 bracts, 1.5–5 × 1–2 cm, membranaceous, ovate, apex acute. Leaves 10–21 × 3–4 cm, 1 per pseudobulb, young leaves with transversal white lines, subcoriaceous, oblong to elliptic, apex acute, base conduplicate. Inflorescence lateral, pendent, 17–36-flowered, up to 15–22.5 cm long; triangular membranous bracts, apex acuminate. Flowers with sepals and petals brownish with yellowish margin; lip yellowish with purplish-brown spots. Sepals ca 1.5 × 0.5 cm, elliptic; dorsal sepal ovate to elliptical, apex acute, base cuneate. Petals ca 1.5 × 0.3 cm, oblong to elliptic; apex acute to acuminate. Lip ca 0.9 × 0.7 cm, 3-lobed; lateral lobes ovate, apex acuminate; midlobe linear, purplish-brown with yellow apex. Column ca 0.7 × 0.3 cm, subcylindrical, base narrow, apex dilated; clinandrium with margin irregularly lacerated, rostellum long and linear; anther cuculate. Pollinia 2, ca 0.1 cm long, obovate, dorsal-ventrally flattened; stipe ca 0.5 cm long, linear, with apex expanded. Fruit not observed. It was observed with flowers from January to May.

Piperaceae

***Peperomia psilostachya* C.DC.**, Mém. Soc. Phys. Genève 32(2): 9, pl. 54, figs 6–9. 1893.

Figures 1, 2G–I

New record. Brazil. São Paulo state. Municipality of Teodoro Sampaio, Parque Estadual do Morro do Diabo: 22°35′50.5″ S, 052°14′49.9″ W, 299 m, 24 February 2017, *Seidinger LC 160* (HASSI 01177).

Description. Epiphyte, repent and pendent. Stems ca. 0.1 cm wide when dry, sparsely hirtellous to pubescent. Leaves 3–5 verticillate; petiole 0.1–0.2 cm long, hirtellous; lamina 0.5–0.9 × 0.4–0.6 cm, coriaceous, adaxial surface glabrous to slightly hirtellous, abaxial surface hirtellous, rhombic to elliptic, base cuneate, apex acute; 3-nerved, acrodromous. Spike ca 3 cm long, terminal; peduncle 1.5–3 cm long; rachis glabrous. Fruits ca 0.1 cm, ovoid, sessile, pseudocupule viscous below the median portion, apex acute. It was observed with fruits in February.

Discussion

Gomesa leinigii is endemic of Brazil and occurs only in the central-northern region of the state of Paraná (Pabst 1972, Flora do Brasil 2018, SpeciesLink 2018). This species is here, for the first time, recorded for the São Paulo state, in the PEMD near the border with Paraná (Fig. 1). Although *G. leinigii* is not evaluated for the

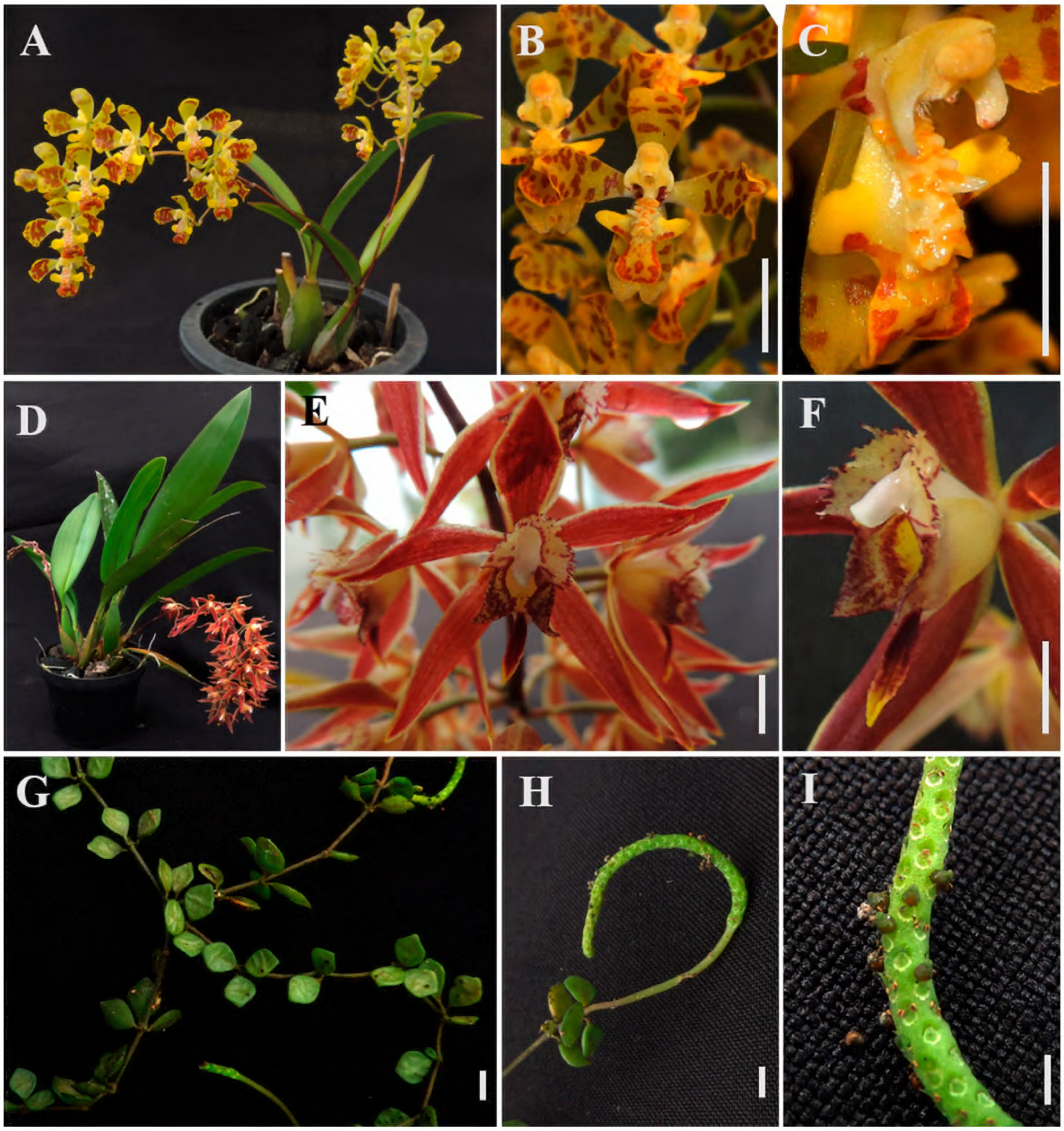

Figure 2. A–C. *Gomesa leinigii*: (**A**) habit; (**B**) flower; (**C**) lip. **D–F.** *Macradenia paraensis*: (**D**) habit; (**E**) flower; (**F**) lip. **G–I.** *Peperomia psilostachya*: (**G**) habit; (**H**) inflorescence; (**I**) ovoid fruits. Scale bars = 0.5 cm. Photographss by Letícia C. Seidinger.

threat of extinction. However, using GeoCAT (Bachman et al. 2011), an area of occupancy (AOO) of 8 km² from 2 localities was calculated and following the criteria of the IUCN (2012a, b), *Gomesa leinigii* should be considered Critically Endangered, B2ab(iv) because of its area of occupancy, geographic distribution, and number of locations. This species is included in the inventory of rare plants in Brazil (Giulietti et al. 2009). It can be easily recognized by the lateral lobes of the lip being large and orbicular and having a sequence of scales in the callus of the lip (Chiron and Castro Neto 2006).

Macradenia paraensis occurs in Bolivia, Brazil, and Paraguay (Govaerts 2018). In Brazil, it occurs in the North (Pará, Rondônia and Tocantins), Central-west (Goiás, Mato Grosso and Mato Grosso do Sul) and Southeast regions (Minas Gerais and São Paulo) (Ferreira et al. 2010, SpeciesLink 2018, Flora do Brasil 2018) (Fig. 1). *Macradenia paraensis* has been assessed as Least Concern, because it is widely occurring in Brazil (Chadburn and Romand-Monnier 2014). It was collected in the PEMD in 1986 and 1989 (SpeciesLink 2018) and the only other record known for the state of São Paulo is the municipality of Brotas, located approximately 400 km from Teodoro Sampaio; this species is rare in the region (Ferreira et al. 2010). The "Lista Oficial das Espécies da Flora Ameaçadas no Estado de São Paulo" categorizes

M. paraensis as Vulnerable (SMA 2016). Here, using GeoCAT (Bachman et al. 2011), an area of occupancy (AOO) of 8 km² from 2 localities was calculated and we consider it to be Critically Endangered B2ab(iv) in São Paulo state following IUCN criteria (2012a, b) because of its area of occupancy, geographic distribution, and number of locations. This species can be recognized by its sweet fragrance and the lip's lateral lobes apex with purplish-brown spots. In the field, 2 individuals of *M. paraensis* were observed in the ground, 1 of which was fertile. Probably, these individuals fell from the phorophyte and, despite being an epiphytic species, managed to survive as terrestrial.

Peperomia psilostachya occurs in Argentina, Bolivia, Brazil, Paraguay, Peru, and Uruguay (Brako et al. 1993, Mai et al. 2016). In Brazil, 3 varieties of *P. psilostachya* are accepted: *P. psilostachya* C.DC. var. *psilostachya*, which occurs in the states of Paraná and Rio Grande do Sul; *P. psilostachya* var. *angustifolia* C.DC., which has been recorded in Espírito Santo, Pará, Paraná and Rio de Janeiro; and *P. psilostachya* var. *glaberrima* C.DC., which occurs only in São Paulo state (Yuncker 1974, Flora do Brasil 2018, SpeciesLink 2018). *Peperomia psilostachya* also occurs in the states of Amazonas, Roraima, Bahia, Goiás, and Mato Grosso do Sul, but there is no report of which of the 3 varieties occurs in each of these states (Flora do Brasil 2018). This species has not IUCN Red List category. However, it is infrequent, especially in São Paulo state, where it was collected in 1967 in the Serra da Cantareira, in 2000 in the Parque Estadual de Campos do Jordão (SpeciesLink 2018), and more recently, in 2017, in the PEMD (Fig. 1). The 2 oldest records were not included in the most recent taxonomic treatment of the Piperaceae of São Paulo state by Guimarães and Carvalho-Silva (2012); they highlighted that new records for the state were not found and used that cited by Yuncker (1974) in the species description. *Peperomia psilostachya* has as distinctive features the rhombic-elliptic, whorled leaves, and comparative short spikes on long, slender peduncles (Yuncker 1974).

The "Lista Oficial das Espécies da Flora do Estado de São Paulo Ameaçadas de Extinção" considered *P. psilostachya* as a Presumably Extinct (SMA 2004), although currently, it is not included in the list (SMA 2016). With our new record in São Paulo state and using GeoCAT (Bachman et al. 2011), an area of occupancy (AOO) of 12 km² from 3 localities and an extent of occurrence (EOO) of 28,751.615 km² was calculated, so we consider it to be Endangered B2ab(iv) in São Paulo state following IUCN criteria (2012a, b) because of its area of occupancy, geographic distribution, and number of locations. Thus, besides our discovery of an extant population in the state, the variety collected in the PEMD is *P. psilostachya* var. *psilostachya*, which is the first record of this variety for the state of São Paulo.

Our new records 3 species in the PEMD helps provide a better understanding of their distribution and demonstrates the importance of the PEMD to maintaining biodiversity. Our study reinforces the importance of floristic inventories even in relatively well-studied regions such as São Paulo state.

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Authors' Contributions

LCS and RGU wrote the manuscript; LCS and WFT collected and identified the specimens.

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